P62-10297

NEWS RELEASE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
400 MARYLAND AVENUE SW, WASHINGTON 25, D C
TELEPHONES WORTH 2-4155 --- WORTH 3-1110

FOR RELEASE: ON DELIVERY
8:00 P.M.
Friday, November 2, 1962

RELEASE NO: 62-235C

Address
by
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National Aeronautics and Space Administration

THE EXPLORERS CLUB
Waldorf Astoria Hotel, New York City
November 2, 1962

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Your invitation to speak here tonight is one which was neither expected nor, indeed, deserved. I have scaled no mountain peaks, braved no arctic wastes, nor penetrated any other new frontiers of land, sea or air, much less those of outer space.

In confessing this to you I am comforted by the knowledge that I do have one qualification which permits me, with some confidence, to be your guest.

I came with Wally Schirra.

You will hear, a little later, from this brave explorer -- the most recent addition to that select group of American astronauts who have gone beyond the earth's atmosphere into the limitless and hostile environment of space. First, however, I will take advantage of this opportunity, which you have so graciously extended to me, to tell you something of the driving national effort which is now under way to give our nation what President Kennedy has called "pre-eminence in space."

I know that you of the Explorers Club are singularly fitted by both temperament and experience to appreciate one of the reasons -- an age-old reason -- for the exploration of space. This is the outreaching curiosity that has never let man rest so long as unknown territory remains to be explored.

The first American in orbit, John Glenn, wrote of the importance of curiosity in a recent article.

"I believe," Col. Glenn wrote, "if everyone retained a child's curiosity throughout his life -- curiosity about ideas as well as things -- all mankind would benefit. Most of the comforts which surround us in our daily lives have resulted from the curiosity of some inventor, scientist or engineer. Inquiring minds are at the root of learning and new knowledge, and all progress in the acquisition of new knowledge forms the basis for more."

The urge to cross the strange river, navigate the unknown sea, and scale the loftiest mountain peak is a characteristic that has impelled the hardier members of the human race throughout the exploration of our own planet. This same characteristic has now launched man into the greatest of all his adventures, the quest for knowledge in distant regions of the universe hitherto beyond his reach.

Curiosity -- the driving human thirst for knowledge -- is only one reason, of course, for undertaking space exploration on the scale and at the pace which our country has established. Other compelling motivations became evident on that day, only a little more than five years ago, when the first man-made satellite was placed in orbit by the Soviet Union. Let me list three which are of greatest significance.

First, we seek for mankind the benefits inherent in the scientific and technological knowledge and dexterity that will emerge from this dynamic effort to conquer the most hostile environment that man has ever entered -- and to use that knowledge and technical skill as an important new resource for human progress.

Second, we seek to maintain our position as leader of the Free World, through continued superiority in science and technology.

And, finally, we seek space power as a deterrent to any potential adversary who might attempt to exploit space as an avenue of aggression against us.

How are we moving toward achievement of our national goal of mastering the space environment and attaining, as the President has urged, "a position second to none?"

Last February, shortly after Col. Glenn's orbital flight, he received a letter from Tenzing Norgay, leader of the Sherpa guides in the conquest of Mt. Everest, which might be of interest to you.

"I have been in the mountains and have been keeping in touch through the radio and have shared the suspense and excitement which, I am sure, has been shared with you by millions of people in all parts of the world," Tenzing wrote.

"When the news of your success reached me, I recalled the excitement after Sir Edmund Hillary and I climbed Everest. Whereas the Everest ascent was of particular value to those interested in mountaineering, your space flight focussed the attention of everyone."

Col. Glenn, in thanking Tenzing for his message, modestly replied:

"I may have gone a bit higher than you did when you climbed Mt. Everest, but it wasn't nearly as much work."

In terms of individual physical effort, that remark was probably true, but in many respects, organization for the exploration and conquest of space is not unlike that which led Tenzing Norgay and the distinguished New Zealander, Sir Edmund Hillary, to the summit of Mt. Everest in 1953.

As most of you will remember, in his book, "The Conquest of Everest," Sir John Hunt writes of the many men and resources involved in the expedition which enabled these two men to ascend and look down from the tallest mountain peak on our planet.

Supporting them were more than 300 porters who had borne the expeditions' equipment and supplies, several dozen Sherpa mountaineers, a core of British experts, including a doctor, a physiologist, a cameraman, and a journalist. All were skilled and experienced mountaineers, hand-picked for the job.

Sir John, an ex-Commando leader, had been chosen to lead the assault because of his experience in leading and training men for mountain campaigns. He planned every step of the effort in meticulous detail.

Much of the equipment used for the Everest expedition had been specially designed for the purpose. Special high-altitude boots were designed and tested, to achieve the degree of warmth and moisture resistance required to meet the conditions prevailing above 26,000 feet. One man on the team was given a course in shoe repair, so that the boots could be kept in shape during the expedition.

Clothing and tents were specially designed for light weight, warmth and resistance to wind and water. Stringent tests were applied, including simulated gales of 100 miles an hour in a wind tunnel. Special oxygen equipment was designed -- spoken of somewhat disdainfully by the Sherpas as "English air." And, finally, the team was given special training, first on the tors of Scotland, then in the Alps, and only then to the lower reaches of Everest.

In our own efforts to conquer space this story is repeated, but on a more elaborate scale. All of our astronauts, on their return from space, have emphasized the team, rather than their individual accomplishment. The personal pronoun is scarcely within their vocabulary, and each has noted the contributions of tens of thousands of persons in government, industry, educational institutions and the military services, to the success of their flight.

But there are other parallels.

The age limits for the astronauts, as originally set, closely approximated the 25-40 year range of the Everest team, but when the additional qualifications were taken into account, it was found that men under the age of 30 could not possibly have all the experience needed.

Each man chosen, for example, had to be a qualified test pilot in high-performance jet aircraft, trained in engineering, under six feet in height, and in superb physical condition. Of the men meeting these qualifications and finally chosen, the youngest was Cooper, 32 years old at the time of selection; and the oldest was Glenn, who was 38.

The clothing and equipment for manned space flight were likewise designed especially for the mission. Not only are the pressurized space suits and space boots individually fitted to each astronaut, but the space couch that supports him against the heavy forces of acceleration and entry is moulded to his exact contours.

An ingenious NASA contractor even produced a special, perspiration-resistant fabric which was used to manufacture special underwear to increase comfort and reduce fatigue during the astronaut's flight.

In manned space flight the environment is far more hostile than that experienced by Hillary and Tenzing at 29,000 feet. Temperatures near absolute zero, conditions of near vacuum, potential exposure to deadly radiation, and collisions with micrometeoroids are but a few of the perils that an astronaut must face.

Consequently, the spacecraft must carry sealed within it, not simply oxygen, but all the essential elements of a workable human environment. All of the complex systems and subsystems in the spacecraft are subjected to innumerable checks as we strive to maintain 100 per cent reliability in manned space flight, and to remove every danger and uncertainty that we can from this ever-hazardous undertaking.

Like the Everest mountaineers, the astronauts also went through a long period of rigorous special training. They practiced climbing in and out of the Mercury capsule as it floated in the ocean. They learned how to survive in the desert and in other harsh environments in case malfunctions sent the spacecraft down in such areas. All went through difficult stamina-building activities, and were subjected to very high pressures, extremes of temperature, and to acceleration on a fast-whirling centrifuge that simulated the heavy gravity stresses of take-off and entry.

In addition to their general training program, the astronauts go through an extensive training program involving the Mercury spacecraft itself. John Glenn, for example, spent 40 hours in formal briefings on the special features of Friendship 7, and more than 100 hours in the actual spacecraft during tests prior to his flight. In addition he and his back-up pilot spent about 90 hours in the procedures trainer during which complete mission simulations were practiced.

The entire Mercury tracking network participated in these simulated flights.

All of this preparation led Glenn to comment that his maiden voyage in space was less novel than might be supposed, because he had already experienced it a hundred times on the ground.

Underlying the achievements of our astronauts, and our other activities in space, is a broad effort which is mobilizing our national resources -- material, physical and intellectual -- to make us first in space.

It is very difficult to give a full picture of NASA activity in a limited time. I would like to mention some of the significant areas which account for most of our effort and do give a good idea of what we are doing.

1. To overtake the Soviet lead in big boosters we are building the Saturn C-1, which will orbit a weight equal to more than seven Mercury capsules like that of John Glenn. We have already had two successful flight tests of the first stage of the C-1, and plan a third later this month. We hope to fly the complete rocket next year. Also under development is the Advanced Saturn C-5 which will place the weight of 85 Mercury capsules in a 300 nautical mile orbit about the earth. The Advanced Saturn C-5 will put more than 100 tons in earth orbit and send more than 40 tons to the vicinity of the moon. The first launch is set for some time in 1965. The C-5 is the launch vehicle we now plan to use for the lunar landing.

   It is difficult for the human mind to comprehend the enormity of a rocket such as the Advanced Saturn. With its three stages fully fueled, it will weigh 1 million 200 thousand pounds. Almost as tall as the Capitol building in Washington, it is 33 feet in diameter and 270 feet high. The five engines of its first stage will burn 4 million 4 hundred thousand pounds of fuel in 150 seconds -- about 900 tons in a minute. The second stage burns more than 450 tons of fuel in less than seven minutes, and the third stage another 115 tons in just over seven minutes.

2. We are building what you might call the ports and shipyards of the space age. This major investment in facilities to fabricate, test, transport and launch these huge rockets will provide the ground facilities essential to space capability. Our timetable for getting to the moon depends on getting these facilities built rapidly. The road to space exploration must be paved with a great deal of steel and concrete poured here on earth, housing giant engineering complexes, controlled

by advanced electronic means, and linked to vast complexes for the production and storage of both conventional and very advanced fuels and oxidizers. Nearly one billion dollars will be devoted to this undertaking in Fiscal Year 1963.

The cost of these installations can be illustrated by telling you about just one of them -- the building at Cape Canaveral which will be used to vertically assemble and check-out the Saturn C-5.

The high-bay area of this structure will be 513 feet long and 418 feet wide, with a roof height of 524 feet. This is almost the height of the Washington monument, and only 100 feet shorter than this hotel (the Waldorf-Astoria) in which we are meeting tonight. Coupled with a low-bay area which measures 589 by 256 feet, it will have a cubic volume greater than that of the Empire State Building, and be as long as two football fields and as wide as a city block.

It also will have what certainly must be the world's tallest door -- 456 feet high -- through which an earth crawler will move the Advanced Saturn rocket, erect, two miles to the launching site.

3. We are building the two-man Gemini spacecraft which will enable our astronauts to spend a week or more in orbit and to perfect the technique of rendezvous in space. The first Gemini flights are expected in 1963 and the first rendezvous maneuvers in 1964. We are also building the three-man Apollo spacecraft which will take American explorers to the vicinity of the moon. Needless to say, we have the men who will fly these craft in training and hard at work.

4. Our program includes an array of versatile scientific spacecraft called Orbiting Observatories. Some of these, including one already flying, will specialize in studies of the sun. Others will be geophysical observatories, and others will take telescopes and other instruments aloft for study of the stars. These are what we call second-generation satellites with many refinements and almost incredible abilities to accurately point their instruments on command from the ground and to store up

and report back great quantities of precise data. For example, the Orbiting Astronomical Observatory, which will carry a 36-inch telescope out beyond the veil of the earth's atmosphere, will "see" many things which cannot be observed with the most powerful 200-inch telescope on earth.

5. We have a vigorous program underway to explore the moon and the planets with unmanned spacecraft. Our recent attempt to reach the moon with the Ranger spacecraft resulted in a near-perfect launch, but the power supply failed to function. We plan nine more Ranger shots at the moon, including four next year and five the year after. Out of this effort, learning from our failures, perfecting our equipment and techniques, we are going to get the results that Ranger is designed to obtain.

   We are also working on a more advanced unmanned lunar landing craft called Surveyor which can deliver working instruments on the moon and also take pictures and make other observations while in orbit around the moon. Ranger and Surveyor spacecraft will yield much information essential to planning the vehicles which will land our first astronauts on the moon and to picking the best landing spot for them.

   Also in the years ahead, Mariner and Voyager spacecraft will tell us more about Mars and Venus as they fly by the planets or go into orbit about them. One Mariner spacecraft, already en route, is expected to yield new knowledge of Venus as it passes that planet on December 14. Ingenious devices are being developed which will collect samples on the planets and report whether life as we know it exists there.

6. Development of nuclear power for rocket propulsion is one of our major goals. This more efficient power for upper stages, utilized with the conventionally fueled lower stages we are building, will give a large increment to our booster capability. Many difficult problems must be overcome, but we are well on the way to solving them, and hope to fly our first nuclear propelled rocket stage well before this decade ends. We are also working on nuclear powered generators to produce electric power in space for long distance communication, to keep our astronauts alive and comfortable, and eventually for

electric propulsion for the long voyages to the planets. When we can put the atom to work for us in space, we will be close to full mastery of that hostile environment.

7. We are well-advanced in the development of communications satellites and of weather satellite systems, which should be operational within the years immediately ahead. We expect to launch a substantial number of experimental communications and weather satellites in the next two or three years.

8. In addition to our communications and weather satellites, and possibly navigation satellites, there is another important area in our applications program. We are making a special effort to see that the new techniques, processes, and materials developed in the space program are made known to industry and put to use wherever profitable in our economy. We are prepared to extend such uses for the benefit of all mankind.

9. To round out this sampling of NASA activities in the national space program, I would also like to mention that we are very much interested in the future supply of highly trained and imaginative engineers and scientists who will help roll back the technological frontiers. We have projects for helping qualified universities build up their research facilities and also for giving scholarships to promising graduate students interested in working in the space and related fields.

With this brief review of our space program in mind, I would like to return for a moment to the comparison of this effort with that which resulted in the achievement of Hillary and Tenzing.

There is another parellel to be drawn which is, I believe, more significant than any recitation of what we are doing, and how we are doing it.

Sir John Hunt, in his book, speaks of the contribution which earlier expeditions made to the scaling of the world's tallest peak.

"The significance of all these other attempts," Sir John writes, "is that regardless of the height they reached, each one added to the mounting sum of experience, and this experience had to reach a certain total before the riddle could be solved.

The building of this pyramid was vital to the whole issue; only when it had attained a certain height was it within the power of any team of mountaineers to fashion its apex."

And then he added, significantly:

"Seen in this light, other expeditions did not fail; they made progress."

Commander Schirra, whom you will hear from shortly, made similar comments about his own experience.

Speaking of those Americans who preceded him in space he has said, "Those earlier flights meant so much in helping me to realize what I needed to do to add to the knowledge that they had already accumulated. This is a continual program in which each of us learns much from the fellow who flew before us."

Both Sir John and Commander Schirra speak knowledgeably about the accumulation of knowledge, skill and experience which must precede ultimate achievement in any undertaking, with failures as well as successes providing the foundation for eventual victory.

It is important that this be remembered as we proceed with determination toward our national goal of conquering space and making its benefits available to mankind.

In the conquest of Everest many men, of many nations, tried and failed, but all added to the store of knowledge and experience which led to success. Many "firsts" were achieved in the conquest of way-points along the route to the summit, but only Hillary and Tenzing were first to attain the summit itself.

A similar situation prevails in the exploration of space. There has been, increasingly, a tendency to regard our program as a race with the Soviet Union to reach the moon. There is an even more alarming tendency to view each new achievement in space as having some ultimate and conclusive significance which will determine which nation is leading in the "race."

To the Explorers Club, perhaps it is not necessary to emphasize that the mastery of space, and its utilization for the benefit of mankind, will not be determined by any single achievement -- even one so advanced as exploration of the moon.

It will be determined by the accumulation of all the scientific knowledge, all of the technology, all of the experience, all of the launch and terminal facilities where space missions can begin and end, and all of the aids to space navigation required for safety and routine operation. These are the resources which will permit man to operate in space as he has learned to operate on the land, on and under the sea, and in the air.

No single display of technological skill, however dramatic, is a valid basis for predicting, in the infancy of space exploration, which nation will achieve ultimate superiority.

I am convinced, however, as are others responsible for the development of the United States space program, that we have laid the foundation for our nation's space power -- for the achievement of pre-eminence in space.

As all of you know, the exploration of space, manned and unmanned, poses problems and challenges far beyond those of any other exploration in the history of man. I hope you will also agree that the rewards to mankind will ultimately justify all of the brainpower, the effort and the resources which are being devoted to it.

As Aristotle recognized long ago, the greatest urge of man is to know -- to achieve a greater understanding of the world around him and his desire to master it intellectually as well as physically.

Perhaps, however, H. G. Wells summed it up best when he wrote:

"For man there is no rest and no ending -- he must go on -- conquest beyond conquest -- beyond this little planet, earth, its winds and ways and all the laws of mind and matter that restrain him. Then he will reach the planets about him. And, at last, he will travel out across immensity to the stars. And, when he has conquered all the deeps of space -- still he will be only beginning."

We are far, as yet, from the conquest of all the "deeps of space," but given the continued support of a great people, and the devotion of men like Commander Schirra and the other thousands who are deeply engaged in the effort, we will continue to make important progress toward that distant, and yet unsought, objective.

And in driving toward it we shall, indeed, achieve the pre-eminence we seek.